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Vegetation and settlement in coastal and inland Norrland from the Neolithic to the Middle Ages

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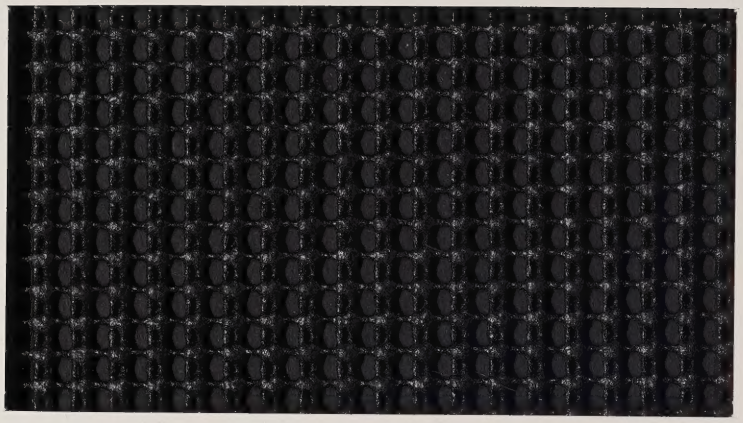

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AKADEMISK AVHANDLING

som med tillstånd av rektorsämbetet vid Umeå universitet för avläggande av filosofie doktorsexamen framlägges till offentlig granskning torsdagen den 25 maj 1978 kl 10.00 i Fysiologi-Botanik Hufo, seminarierum B.

The dissertation is based on the two publications listed below:

1) Engelmark, R. 1976. The vegetational history of the Umeå area during the past 4000 years. - Early Norrland 9, 75-111.

2) Engelmark, R. 1978. The comparative vegetational history of inland and coastal sites in Medelpad, N Sweden, during Iron Age - Early Norrland 11.

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INTRODUCTION

Palaeo-ecological investigations have been carried out in connection with the interdisciplinary research project "Early Norrland". This project was started in 1967, under the aegis of Professor Evert Baudou and superintendent Margareta Biörnstad. The botanical investigations commenced in 1969, under Professor Bengt Pettersson. The first palaeo-botanical results were published in 1972, in the project's own series of research reports "Early Norrland" (Pertti Huttunen and Mirjami Tolonen 1972, Ingrid Olsson 1972 and Kimmo Tolonen 1972). This work was continued, as a further part of the main project, as the "Development of the landscape in Norrland, from prehistoric times onwards", by the author and two other researchers, Ingemar Renberg, a palaeolimnologist, and Olle Zackrisson, an ecologist studying the impact of man on the landscape in historic times. The aim of the present investigation has been to study the postglacial development of the vegetation cover, as the basis for prehistoric man's continued presence in the area, and the effects on the landscape of his usage of this natural resource.

Two geographically different areas were studied, to see if different responses to the above-mentioned problems would be found. The greatest effort was expended in the valley of the river Umeälven, Västerbotten province, where lake and peat deposits were sampled at sites ranging from the coast all the way inland to the mountain range. By making such a transect of the Norrland landscape, any differences in the vegetational history and human settlement in climatically and topographically different regions should be made plain. At present the only published work is that on a lake site just W of Umeå, the site nearest the coast and rivermouth (Engelmark 1976, Renberg 1976, Zackrisson 1976).

A further coastal-inland investigation has been made further south in Medelpad province, in which special emphasis was placed in elucidating the environmental history in the two sub-regions at the time of the archaeologically-evidenced cultural expansion in the Early Iron Age around the Birth of Christ. This investigation, carried out in cooperation with the palaeolimnologist and an archaeologist, is published in the Early Norrland series (Baudou 1978, Engelmark 1978, Renberg 1978). Both peats and lake sediments have been investigated, using biostratigraphical and sometimes also chemostratigraphical methods.

In general the results have been presented in diagrams with a general discussion of their main features. No regionally consistent zonation of the pollen diagrams obtained from the investigations has yet

been attempted, since a firm bases for such a procedure will only exist when the results for the whole of the Umeälven river valley are complete.

The aim of zoning the pollen diagrams has been to provide a reference basis for the discussion of the investigated local problems, within the time framework obtained from the radiocarbon datings. The known metachronism of many of the changes in pollen composition in geographically close regions would have led to more confusion than utility if so called "pollen assemblage" zones had been used. With some minor adjustments, the scheme proposed by Mangerud et al. (1974) has been adapted. All the radiocarbon datings have been made at Uppsala by Professor Ingrid U. Olsson, who has also published comments on them (Olsson 1976, 1978).

VEGETATONAL HISTORY OF THE COASTLANDS OF THE BOTHNIAN GULF

Because the depression of the land surface by the ice cover of the last glaciation was most extensive in the region of the Bothnian Gulf, both sides of the present-day coastland have re-emerged as dry land relatively recently, in geological terms. In consequence, none of the investigated peat or lake deposits are older than 2000 BC and the pollen diagrams correspondingly short.

In the coastal regions the vegetation during this time-span has been similar in both the Umeå district and in Medelpad. Deciduous forest was dominant. Pine forest existed only on the poorer soils, such as those of wave-washed morainic deposits and the very much denuded, higher-lying, land areas, either glacier-smoothed whalebacks or extensive block strewn on rocky hilltops. Birch was the dominant deciduous tree, although the finer grade sediments on the valley floors appear to have been covered by alder carr.

The main difference between the forest vegetation of the Umeå and Medelpad areas seem to have been that in the former area there were only scattered small stands of the warmth-demanding species, hazel and elm, in particularly favourable localities, whereas these trees were more widely-distributed and commoner in Medelpad, where lime was also not uncommonly present in the coastlands by the end of the Sub-Boreal period. In this period subfossil fruits of lime have been found as far north as the Ångermanland coastland (Andersson 1902). The scattered occurrences of lime pollen grains in the diagrams from Västerbotten, however, should be interpreted as long-distance pollen transport. Both the birdcherry and the rowan were important components of the deciduous forest in both regions.

The spruce reached the coastlands at the end of the Sub-Boreal period, a little earlier in Västerbotten (ca 1000 BC) than in Medelpad (ca 800 BC), possibly because of its increased power of competition due to the climatic gradient northwards, and possibly because the soils thereabouts were already more leached, for the same reason. Large numbers of fern spores and pollen of meadowsweet (Filipendula ulmaria) in the sediment samples indicate that both herb-rich and Dryopteris-type deciduous forests were present generally in both regions.

The fact that the elm appears to have been present as far north as Västerbotten at least, during the

Sub-Boreal period should be interpreted as a consequence of the warmer, more favourable climate there at that time, compared with the present-day.

The predominance of deciduous forest suggests, also that the climate was perhaps more oceanic, even though the Sub-Boreal period is generally considered to have been characterized by a continental type of climate. The explanation for this discrepancy is probably that the Bothnian Gulf at that time had stronger local-climatic influence. In 2000 BC both the greater volume of water in the Gulf and its more extensive area would have produced a greater equalization of temperature, especially of temperature extremes. The higher salinity, the greater depth of treshholds at the N and S Kvarken, which would have facilitated water circulation and eased the exchange of water with the Baltic proper, the relative decrease in the inflow of freshwater, etc, are further factors which would have had a favourable effect on the coastal climate of that period.

At the end of the Sub-Boreal the elm declines, the lime reaches Medelpad and the spruce immigrates into both regions. This would seem to indicate an increased continentality of the climate, which first unfavourably affected the elm stands and thereafter the birch-alder forests, a circumstance which would have favoured both the immigration and spread of spruce. The deciduous forest of the Sub-Boreal landscape has no real counterpart at the present-day, except for the narrow fringe of forest which forms a successional stage in the vegetational colonization of the newly-emergent shorelines around the coasts of the Bothnian Gulf. The spruce, which reached both regions at the close of the Sub-Boreal, achieves such high pollenvalues during the first part of the subsequent period, the Sub-Atlantic, that large areas of the deeper soils of the coastlands, which had formerly born deciduous forest, must now have become covered with spruce forest.

Birch and alder are the trees which gave way before the advancing spruce; the pine appears to have been little affected, growing on the poorer and coarser-grade soils. The later development of the forests of the coastal regions is very much affected by human influence. The spruce, having colonized the better soils, was largely decimated during the forest clearances, by axe and fire, carried out by the Iron Age farmers for arable fields, pasture and grazings.

The soil impoverishment which occurred under the spruce coverage of the formerly scarcely-podsolized soils, together with a presumed increase in leaching,

in the end were both unfavourable for the spruce itself. The potential vegetational development in the coastal regions would have been a pretty homogeneous spruce forest on the deeper soils, with birch and alder restricted to the most fine-grained and moist soils and as successional stages in the forest, with pine restricted to the coarser-grained soils and hilltops.

The warmth-demanding deciduous tree species would have disappeared entirely, or only have survived as relict stands in localities with a particularly favourable local climate. This vegetational development is interpreted as being the result of a very marked climatic deterioration.

THE POST-GLACIAL DEVELOPMENT OF THE VEGETATION IN THE INLAND REGION OF CENTRAL NORRLAND

Although the sites from which pollen diagram for the inland region have been obtained are rather restricted geographically, they do provide a coverage of vegetational development throughout the postglacial period, since the last ice-sheet melted. As mentioned earlier, the coastal diagrams necessarily cover a restricted time span. No comparisons can, therefore, be drawn between the two regions during the Boreal and Atlantic periods until further diagrams from the intervening regions exist. The following description is also only applicable to the inland region of Medelpad.

The ice-sheet of the last glaciation finally melted in this area about 9000 years ago, followed by the initial forest colonization, of birch and pine. Judging from the high values of grass pollen in the deposits from this period together with pollen of such poorly-competitive species as sea-buckthorn (Hippophaë rhamnoides) the early forests cannot have had a closed canopy, but were rich in grasses, herbs and shrubs. Pine forest became completely dominant at the end of the Boreal period. The climate is considered to have been at least as warm as the present-day, but markedly more continental in character.

At the start of the following period, the Atlantic (ca 6000 BC) the alder immigrated and spread over the region. During the early part of the Atlantic the pine maintained its forest dominance, but in the second half the birch increases more and more, and even the elm reaches parts of the region. The frequent finds of fossil hazel-nuts from the peatbogs hereabouts date to some extent at least from the end of this period. This prompts the conclusion that the thermoclimate did not improve all that much, compared with that of the Boreal period, until the latter part of the Atlantic period and that the alder expansion was primarily related to the increased humidity and the onset of more stable groundwater conditions.

The subsequent period, the Sub-Boreal, starts about 3000 BC. It is characterized by a gradual return to dominance of the pine in the forests, while birch, alder and elm decline in importance. This is interpreted as an indication of increased continentality of the climate. The spruce immigration in the inland region is considerably later here (ca 500 BC) than nearer the coast. Nor did the spruce ever attain the same relative importance here as it did in the

forests of the coastal region. Local edaphic and/or climatic factors have also given rise to a wide range of variation in the proportional representation of spruce in the inland forests.

At the same time the relatively few and scattered stands of hazel and elm which had managed to survive throughout the Sub-Boreal period now finally disappear for good. A change to a colder and wetter climate would seem to be the cause of these vegetational changes. Decreased temperature and increased precipitation would also have led to increased podsolization and hardpan formation. All these environmental changes will have made life more difficult for the local population of this inland region.

THE PALAEO-ECOLOGICAL EVIDENCE FOR AGRICULTURE AND STOCK-RAISING

Human activities within a forested landscape lead to fundamental local changes in both forest structure and composition. Forest clearance leads to the replacement of the climax community by pioneer communities, which in term give way to a series of vegetational successions before the climax species become re-established.

During the Neolithic period the coastal forests of Norrland were for the most part dominated by birch (Betula pubescens), the most aggressive of our pioneer tree species. When clearances were made in such birch forests, re-establishment involved the same tree species, i.e. such clearances are difficult or impossible to trace in changes in the arboreal pollen percentages in a pollen diagram. However, another possibility exists for tracing human influence on the landscape via a pollen diagram.

Intentionally or otherwise, at least from Neolithic times onwards, where an agricultural economy was adapted, either wholly or partially, man also introduced new species of plants from more southern regions, the so called synanthropic species. Pollen produced by these plants becomes incorporated into the local peats or lake sediments and is thereafter retraceable in pollen analyses of such deposits. The presence of the pollen of cultivated plants provide the most unequivocal information about the type of economy practised in a particular area. The pollen of weeds which are associated with particular types of cultivated ground also provide valuable indications.

Certain of the native species of plants may also be favoured by these activities of man and his animals, albeit unintentionally. In coastal regions, however, a problem arises, due to the presence on the open, nutrient-rich, soils of the newly-emergent shoreline of plant communities which are very similar to those found on cultivated land, ecologically considered. Many seashore plants are represented in the weed flora by closely related species or by ecotypes.

From the pre-Neolithic only pollen diagrams from the inland region exist, and so far no traces of human activity have been found reflected in these diagrams. Pollen analytical evidence for the type of agricultural economy practised in southern Scandinavia from ca 3000 BC onwards is now very extensive

(Iversen 1941, Florin 1957, Fries 1958, Pettersson 1958, Berglund 1966, Königsson 1968, Welinder 1974). From Norrland, on the other hand, there is only a handful of investigations which indicate that even here, although somewhat later, cereal cultivation was practised (Königsson 1970, Tolonen 1972).

In the pollen diagrams presently discussed, there are no certain traces of cultivation in the Neolithic period in the pollen diagrams from Västerbotten. The sparse occurrences of the pollen grains of species generally considered as belonging to the weed flora are more probably derived from shore plant communities.

In the Neolithic sections of the diagrams from the coastal region of Medelpad, on the other hand, there are unequivocal occurrences of the pollen of weed species. The individual pollen curves are discontinuous, but at certain levels concentrations occur. This is interpreted as an indication that human communities practising an extensive type of neolithic farming economy were present in the neighbourhood of the sampling sites during these periods. At certain times they cultivated patches of the forest in the immediate vicinity of the sampling sites, whereupon local concentrations of weed pollen became incorporated into the sediments.

At two sites cereal pollen is also represented, viz. barley-type and wheat-type pollen at ca 2700 and ca 1800 BC respectively. The pollen analyses are, however, unable to provide any more precise information about how the landscape as a whole was utilized at this time. Since the pollen diagrams from all the coastal sites in Medelpad are very similar, it seems reasonable to conclude that quite large areas of forests of the coastal region here were affected by human influence as early as the Neolithic period.

During the first part of the Bronze Age this "neolithic pattern" remains virtually unaltered, but towards the close of this period the signs of human activity increase very markedly in the pollen diagrams from both coastal and inland regions. The spruce had by this time already started to expand in the forests of the coastal region, such that the clearances, followed by short-lived birch re-colonization, are clearly visible in the pollen curve changes. Simultaneously, sporadic occurrences of the pollen of weeds and cereals are recorded.

In the inland region pine is the tree species affected by the clearances, with short-lived birch peaks in the diagrams, but no pollen of cereals

were found. Inland, man cleared patches of forest to provide increased grazing and browsing, in the coast region also for cereal cultivation. Since large areas of forest appear to have been involved, it is probable that deliberate clearance by fire played a large role.

In all three of the investigated areas the late Bronze Age represents a marked "forest clearance" period. The basic explanation, for the coastal/ inland difference, could seem to be the climatic conditions. In marginal areas agriculture is always problematic and difficult, reacting sharply and rapidly to climatic changes.

In the late Bronze Age a warm summer climate enabled good cereal crops to be reaped, so that agriculture expanded at the expense of the hunting - fishing economy, and probably also spread into new areas which had never previously been utilized for crop production. Within the neolithic farming economic pattern, an increased agricultural acreage automatically involved an increase in the areas of land utilized for grazing and browsing, since the small, unmanured, cornfields only yielded satisfactory crops of barley and wheat, as evidenced by the pollen finds, for a few years in succession, whereupon the land lay fallow, or was wholly abandoned.

In a forest ecosystem such successive croppings followed by forest regeneration were essential for a balanced food economy. The combination of crop production with stock-raising provided a more effective utilization of the available manpower and yielded a more balanced diet than either alternative alone, and undoubtedly represented the only alternative form of economy to the earlier hunting - fishing economy. This Neolithic agricultural economy was in general scarcely practicable in the taiga region, only in such locally favourable climatic sub-regions as the coastlands of Norrland. Even here hunting and fishing probably remained an essential complement to agriculture.

The pattern of land utilization seen in Norrland, during the Neolithic and Bronze Age, had been developed by communities settled in the nemoral broad-leaved forest region further south. It had therefore to be modified to make it suitable for the birch-alder, and later spruce, forests of the coastlands of the Bothnian Gulf. The cultivated plant species would also have undergone some gradual selection before they became adapted to and suitable for the edaphic and climatic conditions prevailing in this area. The establishment of the "neolithic" type of economy was therefore a slow, continuous

process. Marginal, trial settlements were probably short-lived when situated too far away from the main area of cultivation.

A marked diminution in agricultural activity takes place about 500 BC. The individual dates obtained vary somewhat (400-600 BC), but when the margins of error, due to calibration of the radiocarbon datings are taken into consideration it is quite probable that the phenomenon was roughly contemporary in all regions. The spruce rapidly regained its former dominance in the forests of the coastal region. Inland, too, spruce increased in importance. Locally it would obviously find suitable colonization conditions on the abandoned small patches of formely cultivated land.

A decline in the mean temperature would obviously have had catastrophic effects on crop cultivation, while an increase in precipitation would have favoured the expansion of spruce in this basically locally-continental climatic region.

In the Umeå region all traces of agricultural activity disappear at this time, only re-appearing about a thousand years later. Hunting and fishing became once more the sole form of economy. In the coastal region of Medelpad, however, there are continued sporadic traces of weed pollen, which may indicate that at least some parts of the landscape around the sampling sites continued to provide grazing for stock.

In Medelpad the pollen diagrams indicate that a further, relatively stable degree of human influence on the landscape became established in the centuries around the Birth of Christ. The curves for crop plants and weeds once again became farily continuous. This would seem to indicate that the previously extensive and transmigratory economy became replaced by a more sedentary type, with permanent settlements.

In the inland area, nevertheless, the traces of human influence in the pollen diagrams are minor and only small areas of the landscape can have been cultivated. Here hunting and fishing must have continued to play a major role in the economy and to provide the community with a surplus sufficient to account for the imported articles documented by the archaeological finds. The shortage of easily-cultivated land would have in any case restricted the scale of settlement in the inland region. Even during the Historic Period the farming hamlets here consisted of only a cluster of farms,

so that during the Iron Age they can scarcely have consisted of more than two or three farmsteads at most.

In the coastal region, on the other hand, there was no such shortage of suitable areas of soil for cultivation and land shortage can scarcely have represented a limiting factor for settlement by agricultural communities. In addition, the climatic conditions here at this time were still appreciably better than these further inland. Crop production and stock-raising would seem to have yielded a tolerable existence and the cultivation of certain additional crops, e.g. flax, which has always occupied a strong position in the agricultural economy of the coastal region of Central Norrland, would have provided a surplus to form a basis for trade. A pollen grain of flax was in fact found in the Rudetjärn lake sediment sample from ca 400 AD. The coastal fisheries and seal hunting may well have been of economic importance, too, for the farmers of the coastal region.

Agriculture and stock-raising were recommended in the Umeå region about 500 AD. The pollen analyses indicate the more or less continuous presence, after this time, of cultivated fields and grazings around two of the investigated localities. In both Medelpad and Västerbotten barley-type pollen is dominant among the cereal-type pollen found. Rye-type pollen only occurs sporadically and it would seem that rye cultivation never achieved any great importance hereabouts.

In both Västerbotten and, especially, the inland region of Medelpad the pollen diagrams bear witness to a very marked increase in the extent of human influence on the landscape at the start of the Middle Ages (ca 1100 AD). New land was obviously brought into cultivation at this time. Certain areas have neither before nor since been so intensively utilized as during this period. Towards the end of the Middle Ages this degree of human influence decreases once more in certain of the investigated areas. Elsewhere it remains at more or less the same level right up to the time of the latest expansion of agriculture and settlement during the 18th-century.

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REFERENCES

Andersson, G. 1902. Hasseln i Sverige fordom och nu. - Sveriges Geol. Unders. Ser. Ca 3.

Baudou, E. 1978. Archaeological investigations at Lake Holmsjön, Medelpad. - Early Norrland 11.

Berglund, B. 1966. Late Quaternary vegetation in eastern Blekinge, southeastern Sweden. A pollen-analytical study. II. Post-Glacial time. - Opera Bot. 12,2.

Engelmark, R. 1976. The vegetational history of the Umeå area during the past 4000 years. - Early Norrland 9.

- 1978. The comparative vegetational history of inland and coastal sites in Medelpad, N Sweden, during Iron Age - Early Norrland 11.

Florin, M-B. 1957. Pollen-analytical evidence of prehistoric agriculture at Mogetorp neolithic settlement, Sweden. In Florin, S. 1957. Vråkulturen. - Stockholm.

Fries, M. 1958. Vegetationsutveckling och odlingshistoria i Varnhemstrakten. En pollenanalytisk undersökning i Västergötland. - Acta Phytogeogr. Suec. 39.

Huttunen, P. & Tolonen, M. 1972. Pollen analytical studies of prehistoric agriculture in northern Ångermanland. - Early Norrland 1.

Iversen, J. 1941. Landnam i Danmarks stenalder. - Danm. Geol. Unders. 2 Raekke, 66.

Königsson, L-K. 1968. The Holocene history of the Great Alvar of Öland. - Acta Phytogeogr. Suec. 55.

- 1970. Traces of Neolithic human influence upon the landscape development at the Bjurselet Settlement, Västerbotten, northern Sweden.- Skytteanska Samfundets Handlingar 7. Umeå.

Mangerud, J., Andersen. S., Berglund, B. and Donner, J. 1974. Quaternary stratigraphy of Norden, a proposal for terminology and classification. - Boreas 3,3.

Olsson I.U. 1972. The C^{14}-dating of samples for botanical studies of prehistoric agriculture in northern Ångermanland - Early Norrland 1.

- 1976. A discussion of the C^{14}-datings from Prästsjön, Joningsmyren and Stormyren. - Early Norrland 9.

- 1978. A discussion of the C^{14}-ages of samples from Medelpad, Sweden. - Early Norrland 11.

Pettersson, B. I958. Dynamik och konstans i Gotlands flora och vegetation. - Acta Phytogeogr. Suec. 40.

Renberg, I. 1976. Palaeolimnological investigations in Lake Prästsjön. - Early Norrland 9.

- 1978. Palaeolimnology and varve counts of the annually laminated sediment of Lake Rudetjärn, northern Sweden. - Early Norrland 11.

Tolonen, K. 1972. On the palaeoecology of the Hamptjärn basin. - Early Norrland 1.

Welinder, S. I974. Kulturlandskapet i Mälarområdet. - University of Lund. Department of Quaternary Geology.

Zackrisson, O. 1976. Vegetation dynamics and land use in the lower reaches of the River Umeälven. - Early Norrland 9.